It will be seen that the sodic sulphate and the magnesia sulphate also occupy a place in Class I.

V. Anhydrous salts examined in this memoir that do not form supersaturated solutions:—

Potassic nitrate.
Potassic bichromate.
Sal-ammoniac.
Sodic nitrate.
Potassic chlorate.
Potassic ferrocyanide.
Baric nitrate.
Plumbic nitrate.
Ammonium nitrate.

III. "On the Impact of Compressible Bodies, considered with reference to the Theory of Pressure." By R. Moon, M.A., Honorary Fellow of Queen's College, Cambridge. Communicated by Prof. J. J. Sylvester. Received April 22, 1868.

(Abstract.)

Suppose that we have two *rigid* cylinders of equal dimensions, which have their axes in the same straight line; suppose, also, that one of the cylinders is at rest while the other moves towards the first with the velocity V in a direction parallel to both the axes; the consequence of the collision which under such circumstances must take place, will manifestly be that half the momentum of the moving cylinder will be withdrawn from it, and will be transferred to the cylinder which originally was at rest.

The mode in which velocity or momentum will thus be collected from the different parts of the one cylinder, and distributed amongst those of the other, is obvious. Exactly the same amount will be withrawn from the velocity of each particle of the impinging cylinder, and exactly the same amount of velocity will be impressed on each particle of the cylinder struck.

And the reason of this is equally obvious; since, if such were not the case, the particles of each cylinder would *contract*—a supposition which is forbidden by the very definition of rigidity.

But if, instead of being perfectly rigid, each cylinder is in the slightest degree compressible, a variation in the effect will occur.

As before, momentum of finite amount will be transferred from the one cylinder to the other, but the mode of collection of the velocity withdrawn from the one, and the mode of distribution of that injected into the other, will no longer be the same as before.

In order that the moving cylinder may not be reduced to absolute rest by the collision, it is obvious that the cylinder originally at rest, or a portion of it, must be moved out of the way, so as to allow of the continuance, even in a modified degree, of the other's motion; and this can only be effected on the terms of a transference of velocity or momentum taking place from the one cylinder, or part of it, to the other cylinder, or part of it.

But when the cylinders are compressible, we are freed from two conditions which obtain when the cylinders are rigid.

In the first place, it is no longer necessary to suppose, neither should we be justified in assuming, that the velocity abstracted from each particle of the impinging cylinder, or transferred to each particle of the cylinder struck, is the same; on the contrary, all experience tells us that, in bodies susceptible to compression, compression is always produced by collision; in other words, that variation of velocity, in the parts about which the collision takes place, is the immediate and invariable concomitant of collision.

In the second place, when the cylinders are compressible, it is no longer essential to suppose that the effect of the collision will be to withdraw velocity from every particle of the impinging cylinder, and to impart velocity to every particle of the cylinder struck. Undoubtedly such may be the case if the cylinders are short, if they are possessed of only a moderate degree of rigidity, and if the velocity before impact of the impinging cylinder is considerable. But if the cylinders be long, while the velocity of the impinging cylinder is of moderate amount, the contrary may occur. The condition that the cylinder originally at rest shall not oppose an immediate insurmountable barrier even to the modified motion of the other may, obviously, be sufficiently satisfied if a motion of contraction is imparted by the collision to a definite portion of the second cylinder.

But when the cylinders are compressible, equally as when they are rigid, the collision must cause the instantaneous abstraction of velocity or momentum, either from the whole of the impinging cylinder, or from a definite part of it, and the instantaneous communication of the velocity so withdrawn, either to the whole of the cylinder struck, or to a definite part of it.

We have hitherto assumed the velocity of each particle of the impinging cylinder to have been originally uniform. Let us now suppose, however, that immediately before impact a counter velocity of variable amount is impressed on the different parts of the impinging body, so that, at the instant of impact, *before taking account of the effect of collision*, the velocity at any point of the impinging body may be expressed by $V-V_1$; where V is constant, but V_1 has the value zero at the surface of collision, and thence gradually increases as we recede towards the other extremity of the cylinder, so that $V-V_1$, which expresses the velocity of the im-

pinging cylinder before impact, has its greatest value at the surface of collision, and diminishes as we recede therefrom.

It is clear that, in the case we are now considering, the collective momentum abstracted from the impinging cylinder by the collision will be less, and finitely less, than that which was abstracted by the collision in the former case, in which the velocity of each particle of the impinging cylinder was supposed uniform and equal to V.

For, if M be the momentum lost by collision when the velocity before impact is uniform and equal to V, it is clear that when the velocity before impact is represented by $V-V_1$, the quantity V_1 may be such that the momentum *before impact* may be finitely less than M; from which it follows inevitably that the amount of momentum lost by collision in this latter case must be less than M.

Let us now vary the *data* by supposing that the velocity before impact *increases* instead of diminishes as we recede from the surface of collision; so that at the moment of impact, before taking account of the effects of collision, the velocity at any point of the impinging cylinder is represented by $V+V_1$ instead of $V-V_1$.

It is clear that the momentum abstracted by the collision in this latter case will be *greater*, and finitely greater, than in the case where the velocity before impact is uniform and equal to V. Let the additional momentum abstracted in this case be M_1, the whole momentum so abstracted being represented by $M+M_1$.

Let us now make a final variation in the conditions of the problem, by supposing that at the moment of impact, and irrespective of the impact, a velocity equal and opposite to V is communicated to each particle of the impinging cylinder, so that at that instant, without taking account of any action of the one cylinder upon the other, the velocities of the two cylinders along their surfaces of contact will be equal, or, rather, will be alike zero; at the same time that at every other point of the impinging cylinder there will be a variable velocity V_1 increasing in amount as we recede from the surface of contact.

In estimating the effect of the cylinders being in contact under the circumstances last described, it is clear that the abstraction from each particle of the impinging body of the velocity V can only be regarded as preventing the transference to the second cylinder of so much of the momentum $M+M_1$ as that velocity, if it had constituted the entire velocity before impact of the impinging body, would have given rise to, viz. M; and that the momentum M_1, whose appearance in the expression $M+M_1$ is due to the fact of the first cylinder having been originally endowed with the variable velocity V_1 in addition to the constant velocity V, will still continue to be transmitted to the second cylinder from the first.

We are thus led to this singular and, doubtless, pregnant conclusion, that in a continuous material system in which there is neither discontinuity of velocity nor discontinuity of density, all the consequences of

collision may occur, viz. the instantaneous transmission of a finite amount of momentum from one part of the system to another, provided we have discontinuity in the *tendency to compression* in the different parts of the system.

The author has endeavoured, in former communications to the Royal Society, to show that when the velocity in a fluid diminishes in the direction to which the motion tends, the slower particles will offer a resistance to the motion of the faster particles, which the received theory fails to take into account. The foregoing speculation goes to prove that the circumstance of the surfaces of contact of contiguous elements of the fluid having the same velocity, constitutes no objection to the reality of such resistance.

IV. "On the Tides of Bombay and Kurrachee." By William Parkes, M.Inst. C.E. Communicated by G. B. Airy, Astronomer Royal. Received May 5, 1865.

(Abstract.)

The object of this paper is to exhibit the phenomena of diurnal inequality in the tides on the coasts of India, and describe the mode adopted by the author for obtaining formulæ based on astronomical elements for predicting them. It is accompanied by the following records of observations given in a diagram form :—

Kurrachee,	1857–8,	December to March.
,,	1865,	March to August.
,,	1867,	The whole year.
Bombay	1867,	February to May.

The height and times predicted by the author for 1867, and published by the India Office, are given on the diagrams for that year, so that they may be compared with actual observation.

The continuous curves of the height of the water taken at Bombay, at every ten minutes for the four months above named, are also given.

By the rotation of the earth every meridian-line is brought twice a day under the influences which ultimately result in the well-known semidiurnal tidal movements—once when in the position nearest to the attracting body, and once when in that furthest from it. But the actual point in that meridian which is in the centre of those influences will be alternately north and south of the equator, to the extent of the declination of the attracting body. This alternation of the position of the centre of attraction from the northern to the southern hemisphere produces a diurnal tide, and that diurnal tide produces a diurnal inequality in the semidiurnal tide